

NERL Publication Report
March 5 – March 12, 2018

Published Articles & Reports

[HYPERL INK "https: //doi.o rg/10.1 111/17 52- 1688.1 2630"]	Alexander, L., K. Fritz, K. Schofield, B. Autrey, J. DeMeester, H. Golden, D. Goodrich, W. Kepner, H. Kiperwas, C. Lane, S. LeDuc, S. Leibowitz, M. McManus, A. Pollard, C. Ridley, M. Vandergoof, and P.J. Wigington (2018) Featured Collection Introduction: Connectivity of Streams and Wetlands to Downstream Waters. JOURNAL OF THE AMERICAN WATER RESOURCES ASSOCIATION https://doi.org/10.1111/1752-1688.12630	SED	Non-Peer Reviewed	SSWR 3.01G
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Impact / Purpose Statement

Cleared by NCEA

Published in the Journal of the American Water Resources Association.

Product Description / Abstract

Connectivity is a fundamental but highly dynamic property of watersheds. Variability in the types and degrees of aquatic ecosystem connectivity presents challenges for researchers and managers seeking to accurately quantify its effects on critical hydrologic, biogeochemical, and biological processes. However, protecting natural gradients of connectivity is key to protecting the range of ecosystem services that aquatic ecosystems provide. In this featured collection, we review the available evidence on connections and functions by which streams and wetlands affect the integrity of downstream waters such as large rivers, lakes, reservoirs, and estuaries. The reviews in this collection focus on the types of waters whose protections under the U.S. Clean Water Act have been called into question by U.S. Supreme Court cases. We synthesize 40+ years of research on longitudinal, lateral, and vertical fluxes of energy, material, and biota between aquatic ecosystems included within the Act's frame of reference. Many questions about the roles of streams and wetlands in sustaining downstream water integrity can be answered from currently available literature, and emerging research is rapidly closing data gaps with exciting new insights into aquatic connectivity and function at local, watershed, and regional scales. Synthesis of foundational and emerging research is needed to support science-based efforts to provide safe, reliable sources of fresh water for present and future generations.

[HYPERL INK "https: //doi.o rg/10.1 111/17	Fritz, K., K.A. Schofield, L. Alexander, M. McManus, H. Golden, C. Lane, W. Kepner, S. LeDuc, J. DeMeester, and A. Pollard (2018) Physical and chemical connectivity of streams and riparian wetlands to downstream waters: a synthesis. JOURNAL OF THE AMERICAN WATER RESOURCES	SED	Peer Reviewed	SSWR 7.1A
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52-1688.12632"]	ASSOCIATION. https://doi.org/10.1111/1752-1688.12632			
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Impact / Purpose Statement

Published in the Journal of the American Water Resources Association.

Product Description / Abstract

Streams, riparian areas, floodplains, alluvial aquifers, and downstream waters (e.g., large rivers, lakes, and oceans) are interconnected by longitudinal, lateral, and vertical fluxes of water, other materials, and energy. Collectively, these interconnected waters are called fluvial hydrosystems. Physical and chemical connectivity within fluvial hydrosystems is created by the transport of nonliving materials (e.g., water, sediment, nutrients, and contaminants) which either do or do not chemically change (chemical and physical connections, respectively). A substantial body of evidence unequivocally demonstrates physical and chemical connectivity between streams and riparian wetlands and downstream waters. Streams and riparian wetlands are structurally connected to downstream waters through the network of continuous channels and floodplain form that make these systems physically contiguous, and the very existence of these structures provides strong geomorphologic evidence for connectivity. Functional connections between streams and riparian wetlands and their downstream waters vary geographically and over time, based on proximity, relative size, environmental setting, material disparity, and intervening units. Because of the complexity and dynamic nature of connections among fluvial hydrosystem units, a complete accounting of the physical and chemical connections and their consequences to downstream waters should aggregate over multiple years to decades.

[HYPERLINK "https://doi.org/10.1111/1752-1688.12636"]	Goodrich, D.C., W. Kepner, L. Levick, and P.J. Wigington (2018) Southwestern Intermittent and Ephemeral Stream Connectivity. JOURNAL OF THE AMERICAN WATER RESOURCES ASSOCIATION. https://doi.org/10.1111/1752-1688.12636	SED	Peer Reviewed	SSWR 7.1A
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Impact / Purpose Statement

Published in the Journal of the American Water Resources Association.

Product Description / Abstract

Ephemeral and intermittent streams are abundant in the arid and semiarid landscapes of the Western and Southwestern United States (U.S.). Connectivity of ephemeral and intermittent streams to the relatively few perennial reaches through runoff is a major driver of the ecohydrology of the region. These streams supply water, sediment, nutrients, and biota to downstream reaches and rivers. In addition, they provide runoff to recharge alluvial and regional groundwater aquifers that support baseflow in perennial mainstem stream reaches over extended periods when little or no precipitation

occurs. Episodic runoff, as well as groundwater inflow to surface water in streams support limited naturally occurring riparian communities. This paper provides an overview and comprehensive examination of factors affecting the hydrologic, chemical, and ecological connectivity of ephemeral and intermittent streams on perennial or intermittent rivers in the arid and semiarid Southwestern U.S. Connectivity as influenced and moderated through the physical landscape, climate, and human impacts to downstream waters or rivers is presented first at the broader Southwestern scale, and secondly drawing on a specific and more detailed example of the San Pedro Basin due to its history of extensive observations and research in the basin. A wide array of evidence clearly illustrates hydrologic, chemical, and ecological connectivity of ephemeral and intermittent streams throughout stream networks.

[HYPERL INK "https: //doi.o rg/10.1 016/j.s citoten v.2017. 11.275 "]	Hubbell, B., D. Costa, W. Cascio, G. Hagler, A. Kaufman, and K. Schulte (2018) Understanding social and behavioral drivers and impacts of air quality sensor use. SCIENCE OF THE TOTAL ENVIRONMENT 621: 886-894, https://doi.org/10.1016/j.scitotenv.2017.11.275	NERL IO	Peer Reviewed	ACE PEP- 4.2
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Impact / Purpose Statement

Cleared by NHEERL

Published in the Science of the Total Environment.

Product Description / Abstract

Background

Lower-cost air quality sensors (hundreds to thousands of dollars) are now available to individuals and communities. This technology is undergoing a rapid and fragmented evolution, resulting in sensors that have uncertain data quality, measure different air pollutants and possess a variety of design attributes. Why and how individuals and communities choose to use sensors is arguably influenced by social context. For example, community experiences with environmental exposures and health effects and related interactions with industry and government can affect trust in traditional air quality monitoring. To date, little social science research has been conducted to evaluate why or how sensors, and sensor data, are used by individuals and communities, or how the introduction of sensors changes the relationship between communities and air quality managers.

Objectives

This commentary uses a risk governance/responsible innovation framework to identify opportunities for interdisciplinary research that brings together social scientists with air quality researchers involved in developing, testing, and deploying sensors in communities.

Discussion

Potential areas for social science research include communities of sensor users; drivers for use of sensors and sensor data; behavioral, socio-political, and ethical implications of introducing sensors into communities; assessing methods for communicating sensor data; and harnessing crowdsourcing capabilities to analyze sensor data.

Conclusions

Social sciences can enhance understanding of perceptions, attitudes, behaviors, and other human

factors that drive levels of engagement with and trust in different types of air quality data. New transdisciplinary research bridging social sciences, natural sciences, engineering, and design fields of study, and involving citizen scientists working with professionals from a variety of backgrounds, can increase our understanding of air sensor technology use and its impacts on air quality and public health.

[HYPERL INK "https: //doi.o rg/10.1 111/17 52- 1688.1 2633"]	Lane, C., S. Leibowitz, B. Autrey, S. LeDuc, and L. Alexander. (2018) Hydrological, Physical, and Chemical Functions and Connectivity of Non-Floodplain Wetlands to Downstream Waters: A Review. JOURNAL OF THE AMERICAN WATER RESOURCES ASSOCIATION. https://doi.org/10.1111/1752-1688.12633	SED	Peer Reviewed	SSWR 3.01G
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Impact / Purpose Statement

Published in the Journal of the American Water Resources Association.

Product Description / Abstract

We reviewed the scientific literature on non-floodplain wetlands (NFWs), freshwater wetlands typically located distal to riparian and floodplain systems, to determine hydrological, physical, and chemical functioning and stream and river network connectivity. We assayed the literature for source, sink, lag, and transformation functions, as well as factors affecting connectivity. We determined NFWs are important landscape components, hydrologically, physically, and chemically affecting downstream aquatic systems. NFWs are hydrologic and chemical sources for other waters, hydrologically connecting across long distances and contributing compounds such as methylated mercury and dissolved organic matter. NFWs reduced flood peaks and maintained baseflows in stream and river networks through hydrologic lag and sink functions, and sequestered or assimilated substantial nutrient inputs through chemical sink and transformative functions. Landscape-scale connectivity of NFWs affects water and material fluxes to downstream river networks, substantially modifying the characteristics and function of downstream waters. Many factors determine the effects of NFW hydrological, physical, and chemical functions on downstream systems, and additional research quantifying these factors and impacts is warranted. We conclude NFWs are hydrologically, chemically, and physically interconnected with stream and river networks though this connectivity varies in frequency, duration, magnitude, and timing.

[HYPERL INK "https: //doi.o rg/10.1 111/17 52- 1688.1 2631"]	Leibowitz, S., P. Wigington, K. Schofield, L. Alexander, M. Vanderhoof, and H. Golden (2018) Connectivity of Streams and Wetlands to Downstream Waters: An Integrated Systems Framework. JOURNAL OF THE AMERICAN WATER RESOURCES ASSOCIATION. https://doi.org/10.1111/1752-1688.12631	SED	Peer Reviewed	SSWR 3.01G
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Impact / Purpose Statement

Cleared by NHEERL

Published in the Journal of the American Water Resources Association.

Product Description / Abstract

Interest in connectivity has increased in the aquatic sciences, partly because of its relevance to the Clean Water Act. This paper has two objectives: (1) Provide a framework to understand hydrological, chemical, and biological connectivity, focusing on how headwater streams and wetlands connect to and contribute to rivers. (2) Review methods to quantify hydrological and chemical connectivity. Streams and wetlands affect river structure and function by altering material and biological fluxes to the river, which depends on two factors: (1) functions within streams and wetlands that affect material fluxes, and (2) connectivity (or isolation) from streams and wetlands to rivers that allows (or prevents) material transport between systems. Connectivity can be described in terms of frequency, magnitude, duration, timing, and rate of change. It results from physical characteristics of a system, e.g., climate, soils, geology, topography, and the spatial distribution of aquatic components. Biological connectivity is also affected by traits and behavior of the biota. Connectivity can be altered by human impacts, often in complex ways. Because of variability in these factors, connectivity is not constant but varies over time and space. Connectivity can be quantified with field-based methods, modeling, and remote sensing. Further research is needed to classify and quantify connectivity of aquatic ecosystems and to understand how impacts affect aquatic connectivity.

[HYPERL INK "https: //doi.o rg/10.5 194/ac p-18- 2615- 2018"]	Mao, JQ; Carlton, A; Cohen, RC; Brune, WH; Brown, SS; Wolfe, GM; Jimenez, JL; Pye, HOT; Ng, NL; Xu, L; McNeill, VF; Tsigaridis, K; McDonald, BC; Warneke, C; Guenther, A; Alvarado, MJ; de Gouw, J; Mickley, LJ; Leibensperger, EM; Mathur, R; Nolte, CG; Portmann, RW; Unger, N; Tosca, M; Horowitz, LW (2018) Southeast Atmosphere Studies: learning from model-observation syntheses. ATMOSPHERIC CHEMISTRY AND PHYSICS, 18 (4):2615-2651; https://doi.org/10.5194/acp-18-2615-2018	CED	Peer Reviewed	ACE AIMS-1.5
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Impact / Purpose Statement

Published in the journal, Atmospheric Chemistry and Physics.

Product Description / Abstract

Concentrations of atmospheric trace species in the United States have changed dramatically over the past several decades in response to pollution control strategies, shifts in domestic energy policy and economics, and economic development (and resulting emission changes) elsewhere in the world. Reliable projections of the future atmosphere require models to not only accurately describe current atmospheric concentrations, but to do so by representing chemical, physical and biological processes with conceptual and quantitative fidelity. Only through incorporation of the processes controlling emissions and chemical mechanisms that represent the key transformations among reactive molecules can models reliably project the impacts of future policy, energy and climate scenarios. Efforts to properly identify and implement the fundamental and controlling mechanisms in atmospheric models benefit from intensive observation periods, during which collocated measurements of diverse, speciated chemicals in both the gas and condensed phases are obtained. The Southeast Atmosphere Studies (SAS, including SENEX, SOAS, NOMADSS and SEAC4RS) conducted during the summer of 2013 provided an

unprecedented opportunity for the atmospheric modeling community to come together to evaluate, diagnose and improve the representation of fundamental climate and air quality processes in models of varying temporal and spatial scales.

This paper is aimed at discussing progress in evaluating, diagnosing and improving air quality and climate modeling using comparisons to SAS observations as a guide to thinking about improvements to mechanisms and parameterizations in models. The effort focused primarily on model representation of fundamental atmospheric processes that are essential to the formation of ozone, secondary organic aerosol (SOA) and other trace species in the troposphere, with the ultimate goal of understanding the radiative impacts of these species in the southeast and elsewhere. Here we address questions surrounding four key themes: gas-phase chemistry, aerosol chemistry, regional climate and chemistry interactions, and natural and anthropogenic emissions. We expect this review to serve as a guidance for future modeling efforts.

[HYPERL INK "https: //doi.o rg/10.1 111/17 52- 1688.1 2634"]	Schofield, K., L. Alexander, C. Ridley, M. Vanderhoof, K. Fritz, B. Autrey, J. DeMeester, W. Kepner, C. Lane, S. Leibowitz, and A. Pollard. Biota connect aquatic habitats throughout freshwater ecosystem mosaics. JOURNAL OF THE AMERICAN WATER RESOURCES ASSOCIATION. https://doi.org/10.1111/1752-1688.12634	SED	Peer Reviewed	SSWR 3.1G
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Impact / Purpose Statement

Cleared by NCEA

Published in the Journal of the American Water Resources Association.

Product Description / Abstract

Freshwater ecosystems are linked at various spatial and temporal scales by movements of biota adapted to life in water. We review the literature on movements of aquatic organisms that connect different types of freshwater habitats, focusing on linkages from streams and wetlands to downstream waters. Here, streams, wetlands, rivers, lakes, ponds, and other freshwater habitats are viewed as dynamic freshwater ecosystem mosaics (FEMs) that collectively provide the resources needed to sustain aquatic life. Based on existing evidence, it is clear that biotic linkages throughout FEMs have important consequences for biological integrity and biodiversity. All aquatic organisms move within and among FEM components, but differ in the mode, frequency, distance, and timing of their movements. These movements allow biota to recolonize habitats, avoid inbreeding, escape stressors, locate mates, and acquire resources. Cumulatively, these individual movements connect populations within and among FEMs and contribute to local and regional diversity, resilience to disturbance, and persistence of aquatic species in the face of environmental change. Thus, the biological connections established by movement of biota among streams, wetlands, and downstream waters are critical to the ecological integrity of these systems. Future research will help advance our understanding of the movements that link FEMs and their cumulative effects on downstream waters.

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